

CLAIMS

1. An optical communications module comprising:
at least one of a light-emitting device and a light-receiving device;
5 at least one of a first optical transmission line transmitting light from
said light-emitting device and a second transmission line transmitting light to said
light-receiving device;
an optical component optically coupling at least one of said light-
emitting device and said first optical transmission line, and said light-receiving
10 device and said second optical transmission line; and
a substrate on whose surface a cavity is formed, said cavity having a
floor and at least one step, and at least one of a group of said light-emitting device,
said optical component and said first optical transmission line, and a group of said
light-receiving device, said optical component and said second optical transmission
15 line being mounted on said cavity.
2. The optical communications module as defined in Claim 1, wherein
an optical axis of one of said light-emitting device and said light-receiving device and
an optical axis of said optical component are matched by abutting at least one of said
20 first optical transmission line and said second optical transmission line on said cavity.
3. The optical communications module as defined in Claim 1, wherein
at least one of said first optical transmission line and said second optical transmission
line is made of one of a plastic fiber and a plastic-clad fiber.
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4. The optical communications module as defined in Claim 1, wherein
said light-emitting device includes one of a light-emitting diode and a laser diode,

and said light-receiving device includes a photo diode.

5. The optical communications module as defined in Claim 1, wherein said optical component includes a refractive lens.

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6. The optical communications module as defined in Claim 1, wherein said optical component includes a diffractive lens.

7. The optical communications module as defined in Claim 1, wherein
10 said optical component includes an optical iris.

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8. The optical communications module as defined in Claim 1, wherein said optical component hermetically seals at least one of said light-emitting device and said light-receiving device.

9. The optical communications module as defined in Claim 1, wherein said optical component is hermetically sealed onto said cavity by one of glass, resin, and solder.

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10. The optical communications module as defined in Claim 1, wherein at least one of said light-emitting device and said light-receiving device is disposed on said floor of said cavity, and said optical component and at least one of said first optical transmission line and said second optical transmission line are disposed on said step of said cavity.

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11. The optical communications module as defined in Claim 1, wherein said cavity has one of one and a plurality of said steps, and at least one of a

group of said optical component and said first optical transmission line, and a group of said optical component and said second optical transmission line is disposed on a first step, said first step being one of one and the plurality of said steps.

5 12. The optical communications module as defined in Claim 1, wherein an outline of said step where one of said first optical transmission line and said second optical transmission line is disposed and an outline of said optical component are same as an outline of one of said first optical transmission line and said second optical transmission line disposed on said step.

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 13. The optical communications module as defined in Claim 1, wherein said step of said cavity is provided in a plurality and includes a first step and a second step which is one level below said first step, at least one of said first optical transmission line and said second optical transmission line is disposed on said first
15 step, and said optical component is disposed on said second step.

 14. The optical communications module as defined in Claim 1, wherein at least one of said first optical transmission line and said second optical transmission line is disposed separately from said optical component.

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 15. The optical communications module as defined in Claim 13, wherein said cavity has a third step between said first step and said second step.

 16. The optical communications module as defined in Claim 13,
25 wherein a height of said second step is greater than a thickness of said optical component.

17. The optical communications module as defined in Claim 13, wherein an outline of said second step is larger than a core of one of said first optical transmission line and said second optical transmission line disposed on said first step.

5 18. The optical communications module as defined in Claim 1, wherein said cavity has at least three steps, and said optical component is provided in a plurality, said optical components having different outlines are disposed on said cavity on a same optical axis.

10 19. The optical communications module as defined in Claim 1, wherein said substrate is a multilayer ceramic substrate having the number of layers two more than the number of step(s) of said cavity.

15 20. The optical communications module as defined in Claim 19, wherein a ceramic layer which becomes said floor of said cavity is made through a process including at least firing of powder.

20 21. The optical communications module as defined in Claim 1, wherein a height of the step one level upper the floor of said cavity is equivalent to a thickness of at least one of said light-emitting device and said light-receiving device.

22. The optical communications module as defined in Claim 1, wherein a semiconductor device for controlling at least one of said light-emitting device and said light-receiving device is mounted on said substrate.

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23. A substrate for optical communications module, said optical communications module comprising:

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at least one of a light-emitting device and a light-receiving device;

at least one of a first optical transmission line for transmitting light from said light-emitting device and a second optical transmission line for transmitting light to said light-receiving device; and

5 an optical component for optically coupling at least one of said light-emitting device and said first optical transmission line, and said light-receiving device and said second optical transmission line;

 wherein a cavity having a floor and at least one step is formed on a surface of said substrate, and at least one of a group of said light-emitting device,
10 said optical component and said first optical transmission line, and a group of said light-receiving device, said optical component, and said second optical transmission line is mounted on said cavity.

 24. The substrate as defined in Claim 23, wherein an outline of said
15 step on which one of said first optical transmission line and said second optical transmission line is disposed, and an outline of said optical component are same as an outline of one of said first optical transmission line and said second optical transmission line disposed on said step.

20 25. The substrate as defined in Claim 23, wherein said step of said cavity is provided in a plurality and includes a first step and a second step which is one level below said first step, at least one of said first optical transmission line and said second optical transmission line is disposed on said first step, and said optical component is disposed on said second step.

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 26. The substrate as defined in Claim 25, wherein a height of said second step is greater than a thickness of said optical component.

27. The substrate as defined in Claim 25, wherein an outline of said second step is larger than a core of one of said first optical transmission line and said second optical transmission line disposed on said first step.

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28. The substrate as defined in Claim 25, wherein said cavity has a third step between said first step and said second step.

29. The substrate as defined in Claim 28, wherein an outline of said
10 third step is same as an outline of a third optical transmission line, said third optical transmission line having a outer diameter smaller than that of at least one of said first optical transmission line and said second optical transmission line.

30. The substrate as defined in Claim 29, wherein an outline of said
15 second step is larger than a core of said third optical transmission line.

31. The substrate as defined in Claim 25, wherein said cavity has a
third step between said first step and said second step, said third step has an outline
same as an outline of a third optical transmission line, said third optical transmission
20 line having a outer diameter smaller than that of at least one of said first optical transmission line and said second optical transmission line.